The street children of Manila are affected by early-in-life periodontal infection: description of a treatment modality: sea salt

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Introduction

Periodontal disease is one of the most common forms of oral diseases and some aggressive forms manifest early in life (1). In individuals ≤ 25 years of age, the presence of two or more interproximal, nonadjacent sites with clinical attachment loss of ≥ 4 mm occurring at a minimum of two different teeth and accompanied by bleeding on probing, signifies aggressive periodontitis (2). Baer (1971) estimated that the loss of attachment in aggressive periodontitis patients was three or four times faster than in cases of chronic periodontitis (3).

Patients affected by aggressive periodontitis are significantly younger than individuals affected by chronic periodontitis (Pic. 1-3) (3). The extrusion or protrusion of maxillary incisors following periodontal attachment loss, extensive destruction of anterior papilla, or loss of maxillary central incisors seriously damages facial expression (4, 5). The loss of the smile is emotionally and socially relevant for a child's interaction with society (1, 6).

Little attention has been directed toward evidence that an early-in-life oral infection is threatening the health of youth in Manila in the Republic of the Philippines with the potential to reach epidemic proportions. The silent infection is targeting thousands of children and their smiles (7). Several microorganisms such as Aggregatibacter actinomycetemcomitans, Porphyromonas gingivalis, Tannerella forsythia, Campylobacter rectus, Prevotella nigrescens, and Treponema denticola have been implicated as important initiators of periodontal disease in children and young adults (8).

In 2004, White introduced salt water therapy as an archeaic yet effective way of killing the oral bacteria (9). Modern physicians prescribe salt water rinses for the treatment of sore throats. Sea salt is a clear mineral that contains the elements of sodium and chlorine, iodine, magnesium, sulfur, calcium, potassium, phosphorus, fluorine, titanium, beryllium, germanium, and zinc (10). In ancient Egypt, a crucial component of mummification process was salt which was also used to cleanse the body, minor cuts and wounds. In the 1st century AD, the Greek physician Pedanios Dioskurides wrote that salt was an effective remedy for suppurating wounds (11).

As early as 1905, Carlsbad salt, consisting of a mixture of potassium sulfate, sodium chloride, sodium bicarbonate and sodium sulfate, was recommended for use in gingival pockets after calculus removal (12). In 1982, Ekborn et al. reported reduction of plaque formation utilizing saline rinses, with an absence of secondary effects and a minimal cost.

The aim of the present investigation was to evaluate the effectiveness of a sea salt mouthrinse solution in a group of 617 street children of Manila (Philippines) living in Virlanie Foundation and affected by mild to severe forms of early-in-life periodontal disease.

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Materials & Methods

During three oral-health missions in 2003, 2004 and 2005, 617 abandoned children, who were living in the streets of Manila in the Philippines (Pic. 4), received oral examination at a non-sectarian child-caring institution in Metro Manila (Virlanie Foundation). These children were all in need of special protection: abandoned, abused, exploited, neglected, orphaned, poor. The children were 5-13 years old. Handicapped children were not included in this study. However, it should be noted that in Manila, the prevalence of periodontal disease in orphaned handicapped children is extremely high. The study, approved by the University of Rennes in France and Child-caring Institution in Manila, was supported by French volunteers and more than 100 Filipino staff (Pic. 5). No possibility for conventional periodontal treatment was available.

Periodontal examinations, performed by calibrated examiners, included the measurement of DMFT index (13), that quantifies dental health status based on the number of carious, missing and filled teeth, gingival index (Loë and Silness) (14), plaque index (Loë and Silness) (15), and periodontal index (Ramfjord) (16). Children affected by gingivitis (70%) and aggressive periodontitis (3.4%) were identified. A treatment based on what could be done for these young abandoned children was proposed:

1. Teaching of a precise tooth brushing technique with sea-salt, controlled and reinforced every two days for one week by calibrated oral health educators,
2. The application of sea-salt water mouthrinse – one spoonful per glass of water; twice a day every other week (2.5 gram in 20 ml).

Periodontal measurements were repeated at the end of each mission.
Results

All children returned to the child-caring institution for the follow-up examinations. Children diagnosed with aggressive periodontitis in 2003 were 10 male and 11 female (n=21). At the last evaluations in 2009-2010, none was affected by aggressive periodontitis. For all patients, the gingival index decreased from 1.08 at the first mission to 1.04 at the end of the second mission and 0.98 at the last mission (Fig. 1). The presence of abundant bacterial plaque (plaque Index ≥ 2) was observed in 43% of the patients at mission 1 and 29% at mission 3 (Fig 2). The periodontal index decreased from 1.33 at the first mission to 0.98 at the second mission and 0.92 at the last mission. Fig. 2 shows the evolution of the DMFT index.

Discussion

Research has led to a variety of approaches to improve periodontal health through prevention and early diagnosis. The results of the present investigation confirm that prevention and early diagnosis can result in success with minimum cost. The results of the present investigation also show that periodontal health can be achieved through a simple awareness campaign even in difficult conditions. The provided oral health program empowered street children in the most desperate circumstances to be educated and become self-reliant, independent, and responsible. Patient compliance and attitude plays a major role in the implementation of self-maintenance of oral health. Oral hygiene should be incorporated and established early in life as part of a healthy lifestyle (17). It is important to note that oral hygiene is a habitual behavior in the daily routine. Human behavior studies indicate that the performance of any task can be improved tremendously if a maximum level of motivation is applied (17). Minimum motivation is needed once the patient has learned the procedure and incorporated it into his routine. A small or moderate increase in motivation may not have a significant improvement in performance. However, a maximum level of motivation is highly likely to improve task performance (17). The severe gingival inflammation was reversed by using sea salt rinse and brushing. Important improvements could be measured between the missions, even in children with a high plaque index. The negative impact of severe gingivitis, associated or not with periodontitis, should be recognized.
Children affected by plaque induced gingival inflammation are at risk of harboring active periodontal pathogens and viruses (18). The overgrown and inflamed gingival tissue can be considered sites of active microbial and viral replication (18, 19). However, little attention is given to gingivitis when compared to periodontitis perhaps because its danger is not taken seriously. Assuming that periodontal herpesviruses can reside in inflammatory cells (20), a reduction of gingival inflammation by sea-salt solution could reduce periodontal herpesvirus counts as well.

Gingivitis is an inflammatory disease which is associated with periodontal pocket depths ranging from 2 to 4 mm. Caregivers are in a unique position to reduce or eliminate the risk of gingival inflammation in children and reduce or eliminate early-in-life periodontal disease and dental decay. The authors of this article believe that the best way to fight aggressive periodontitis in low-income countries is to resort to mothers, caregivers, or volunteers. Mothers should be asked to spend a few minutes of their time on this job. When mother performs hygiene, there is less resistance on the part of the child. There is more trust between mother and child. While escaping from the child-caring institutions is a common experience, all of the children involved in this project returned to see the caring volunteers.

The evolution of DMFT index (Fig. 3) in the present study further signifies the positive impact of the suggested preventive measure in reducing the number of decayed teeth from 3.5 in mission 1 to 0.5 in mission 3. During the same time period, tooth loss (Fig. 4) increased from 0.5 to 1.5 only.

**Fig. 3.** The overall gingival index at mission 1, 2, 3.

![Gingival inflammation chart](chart.png)

**Fig. 4.** Periodontal index of the patients at mission 1, 2, 3.

![Periodontal index chart](chart2.png)

The osmotic power and the absorbent effect may explain the antimicrobial action of salt (9, 21). Bacterial cell walls are not rigid and can be expanded (22). Indeed, bacterial cell walls withstand internal pressure of 100 atm (23). However, an increase in osmolarity may be accompanied by an intracellular influx of water and an osmotic shock (24, 25). While a hypoosmotic shock generally results in a minor increase of cell volume, a hyperosmotic shock causes cytoplasmic shrinkage (26), plasmolysis, the inhibition of nutrient uptake (Roth, 1985) (27) and DNA replication (22, 28, 29). Proteins and other biological macromolecules have evolved to function only within a narrow osmotic range (Koch, 1984) (22). Sreenivasan et al. investigated the metabolic requirements for the routine growth of A. actinomycetemcomitans. The optimal pH for growth of A. actinomycetemcomitans ranged 7.0-8 in a medium containing 0.5-1% of NaCl. High concentrations such as 5% NaCl resulted in a very low optical density of 0.04 (30).

White and Armaleh (9), in a randomized study, evaluated the effects of three oral hygiene techniques on salivary mutants streptococci in 60 patients: After routine tooth brushing, Group I was asked to use a tongue scraper to clean the tongue once daily in the morning. Group II was asked to place and let dissolve a Listerine Oral Care Strip on the tongue once daily. Group III was asked to rinse once every morning, for thirty seconds, with a saturated saline solution. Baseline, one hour, three day, and seven day saliva samples were obtained. All treatment groups showed a significant reduction in colony counts. The most effective treatment was “Tongue Scraping”, however, salt-therapy was more effective than the “Listerine Strip”.

Newburn et al. evaluated the effect of various salts (NaHCO3, NaCl, MgSO4) on bacteria representative of soil, skin and fecal flora and of subgingival and subgingival flora (24). Suspected periodontal pathogens were more susceptible to salts than were control non-oral bacteria. Periodontal pathogens were more susceptible to NaHCO3 than to NaCl. NaHCO3 and KHCO3 showed similar activity against all strains tested. The authors suggested that the antibacterial activity of NaHCO3 was not simply an osmotic effect and was due to the bicarbonate ion; the higher the concentration of bicarbonate, the faster the lethality. Morphologic examination of organisms by transmission electron microscopy revealed marked fibrillar condensations within the cytoplasm and shrinkage of the cytoplasm from the outer membrane. The authors concluded that one advantage of NaHCO3 over other antimicrobial agents was its safety, availability and low cost. A much higher concentration of salt was used in the present investigation (12.5% vs. 1.5-4.1%).

Wolff et al. investigated the effect of conventional oral hygiene (n = 116 subjects) versus a salt and peroxide oral hygiene regimen (n = 115 subjects) on subgingival microorganisms (31). Subgingival plaque for microscopic evaluation was obtained from eight index tooth sites in each of 231 adult subjects at baseline, 8, 16, and 24 months. For both oral hygiene groups, motile rods were decreased at 8 months (P < 0.05). Spirochetes were decreased and remained low through 24 months in both oral hygiene groups (P < 0.05). The authors concluded that a significant change in microbial signs associated with periodontal disease may be obtained with either a conventional oral hygiene or a salt and peroxide oral hygiene home care regimen. Wolff et al. also in a 4-year investigation of salt and peroxide regimens compared with conventional oral hygiene evaluated 171 subjects (32). Results indicated that both regimens were effective in changing clinical measures of periodontal disease to a state favoring periodontal health.

Bakdash et al. evaluated patient compliance with, and acceptance of, a salt and peroxide oral hygiene regimen compared with conventional oral hygiene regimens without or with the use of phase-contrast microscope viewing of subgingival plaque over a period of 2 years (33). A total of 231 subjects with early to moderate periodontitis were randomly divided into four groups. All groups were repeatedly instructed and motivated in their respective regimens. Results indicated that 74% and 58% (P < 0.01) of subjects in the conventional and salt/peroxide groups, respectively, used their assigned regimen 4 to 7 days a week during the entire study. Eighty per cent and 57% (P < 0.01) of the conventional and salt/peroxide groups, respectively, stated that they liked their regimens. Ninety-six per cent of all subjects felt that their regimen helped their periodontal status. Our results also confirm the impact of instruction and motivation to achieve high level of acceptance of the assigned regimen.

Rosling et al. in a controlled study, evaluated the microbiological and clinical effects of a subgingivally applied mixture of H2O2-NaCl and NaHCO3 in 20 patients affected by moderate to severe periodontal disease (34). 10 patients were instructed to use the antimicrobial mixture twice a day instead of dentifrice, and also received professional application of the mixture once every 14 days for 3 months in connection with reinstruction in oral hygiene procedures. The study showed that the antimicrobial agents reduced the subgingival microflora and substantially improved early periodontal healing including gain of probing attachment level and gain in radiographic alveolar bone mass during the 12 months of observation. The authors concluded that application of a mixture of H2O2-NaCl and NaHCO3 will significantly enhance the microbiological and clinical effects of periodontal scaling and root planing. They also concluded that the topical mode of antimicrobial therapy seem promising in the management of human periodontal diseases.

Binney et al., in a single blind, randomized, cross-over
The 2008 poverty data from the World Bank estimate that can be implemented which has We measured by low-income countries were living low-cost resources, prevention preventing plaque regrowth. 1.4 billion people (one-quarter (Reach) (35). Chlorhexidine saline and (0.9%), sodium benzoate (2%) with sodium carbonate sodium lauryl sulphate (0.25%) (Plax) and cetyl pyridinium chloride (0.05%) with sodium fluoride (0.05%) (Reach) (35). Chlorhexidine was the positive control and saline and toothpaste slurry was the negative control. The results showed that with the exception of the peroxylborate rinse, none of the other rinses were superior to saline for preventing plaque regrowth.

Conclusion
We propose here an antimicrobial approach to the prevention and treatment of periodontal disease in children which has a high degree of efficacy and tolerability, and can be implemented in virtually all parts of the world using low-cost resources.

The 2008 poverty data from the World Bank estimate that 1.4 billion people (one-quarter of the population) in 115 low-income countries were living in extreme poverty, as measured by the 1.25$ a day poverty line of purchasing power (Fig. 5). International resources can play a significant part to create a simple worldwide educational program to eradicate the disease. The present experience provides evidence that the reduction or elimination of periodontal pathogens does not call for heavy operating systems or resort to pharmaceutical enterprises and high volume investments with intricate bureaucracy. The present article provides support for a new and hopeful way of speaking about an otherwise tragic tale in many parts of the globe... The smile of children.

References
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